

1. Introduction

The light flicker measuring device LiFli enables quick assessment of light sources for their flicker components (flickers). Especially for LED light sources, the flicker component can be determined only by a measurement, since it is within the range of 0% to 100 % in case of these light sources. Audio functions enable an acoustic reproduction of the flicker. A voltage output for further analysis using oscilloscope or spectrum analyzer is available.

2. Device description

2.1. Operating and indication elements



- ❶ LED audio function up to 20 kHz
- ❷ LED audio function from 20 kHz up to 400 kHz
- ❸ Bar display
- ❹ On/audio key
- ❺ Volume down key
- ❻ Volume up key
- ❼ Charging indicator
- ❽ Charging socket
- ❾ Voltage output

2.2. Sensor

The sensor is located at the front of LiFli. The spectral sensitivity resembles that of the human eye. The sensor records flickers from the range of 50 Hz up to 400 kHz.

2.3. Turn on/off and battery indicator

LiFli is turned on through the **on/audio** key ④. One-second signal tone beeps, during which the charging status of batteries is displayed on the bar display in the range of 0..100%. LiFli is turned off by pressing of the audio key for one second.

If no key is pressed for a period of 30 minutes or the battery falls short of minimum voltage, then LiFli automatically turns off.

2.4. Display of flicker component

The LED-bar display ⑤ displays the flicker component of the light source in 18 steps in percent:

2% 4% 6% 8% 10% 15% 20% 25% 30% 35% 40% 45% 50% 60% 70% 80% 90% 100%

If the illuminance for the assessment of flicker component is very low, then 2%-LED flashes. If the maximum permissible illuminance exceeds, then 100%-LED flashes and a warning sound beeps.

2.5. Audio functions

LiFli can acoustically reproduce the flicker in audible range from 20 kHz..400 kHz using two audio functions.

The audio function is inactive after turning on; it is activated for the audible range using the **audio** key ④; the LED ① is illuminated in green. By repressing, the function for the range from 20 kHz..400 kHz is activated; the LED ② is illuminated in green. In this mode, the complete flicker frequency of this range is simultaneously projected in audible range.

The volume can be set in five levels using the **volume down/volume up** keys ⑤/⑥.

2.6. Voltage output

The voltage output ⑨ enables analysis of measurement signal using oscilloscope or spectrum analyzer. The frequency range of the output is 50 Hz..400 kHz. The maximum output voltage is 2 V.

2.7. Charging the battery

LiFli has rechargeable Lithium-Ion batteries. The operating time significantly depends on the volume in case of active audio function and is in between one and 20 hours.

Charging is done through the charging socket ⑩ (micro-B-USB) with a power supply of 5 V/1000 mA.

This corresponds to the standard charger for mobile device. Never use other chargers; this may lead to damage the LiFli. Never charge in the vicinity of combustible material or gases. Never charge batteries unattended!

Recharge device approximately every 6 months in case of prolonged non-usage.

Charging is done once the charger is plugged in; this is visible through the light of charging indicator-LED ⑦. The charging time is approximately three hours for discharged battery. The charging indicator goes out after completion of charging.

If the charging indicator blinks 1.5 times per second, then this indicates that the battery temperature is beyond the permissible range

If the charging indicator blinks 6 times in a second, then this indicates that the battery is defective.

2.8. Calculation of flicker component

LiFli calculates the flicker component according to the following selectable procedures:

Ripple content:

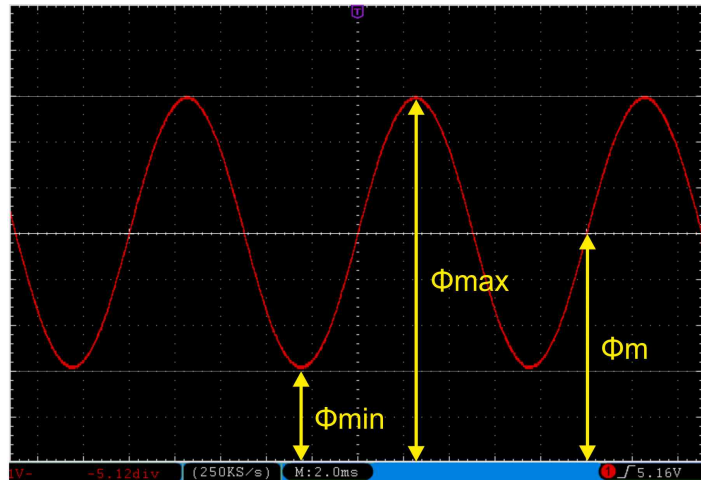
$$W = \frac{\Phi_{\max} - \Phi_{\min}}{\Phi_{\max}} * 100\%$$

In accordance with the *Standard of Building Biology Testing Methods SBM-2015*.

Flicker%:

$$F \% = \frac{\Phi_{\max} - \Phi_{\min}}{\Phi_{\max} + \Phi_{\min}} * 100\%$$

In accordance with *IESNA*.



Luminous flux ϕ in Lumen (lm)

The adjusted calculation type is shown when the LiFli is powered on.

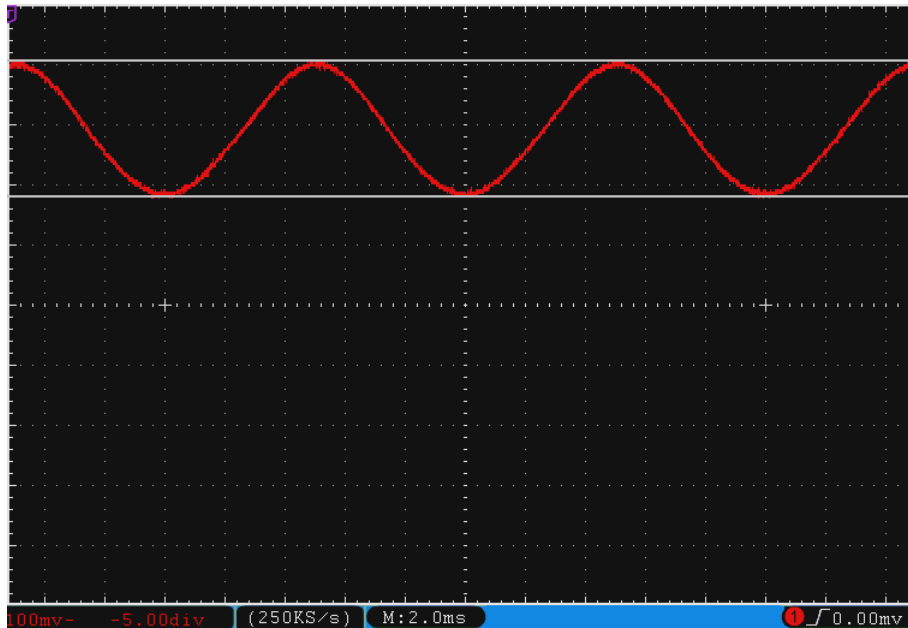
Calculation type	Tone sequence
Ripple content	— —
Flicker%	- - -

The calculation type is changed by pressing the on/audio key ④ five seconds when powering-on the LiFli. The change is confirmed by a signal tone.

2.9. Measurement of flicker component

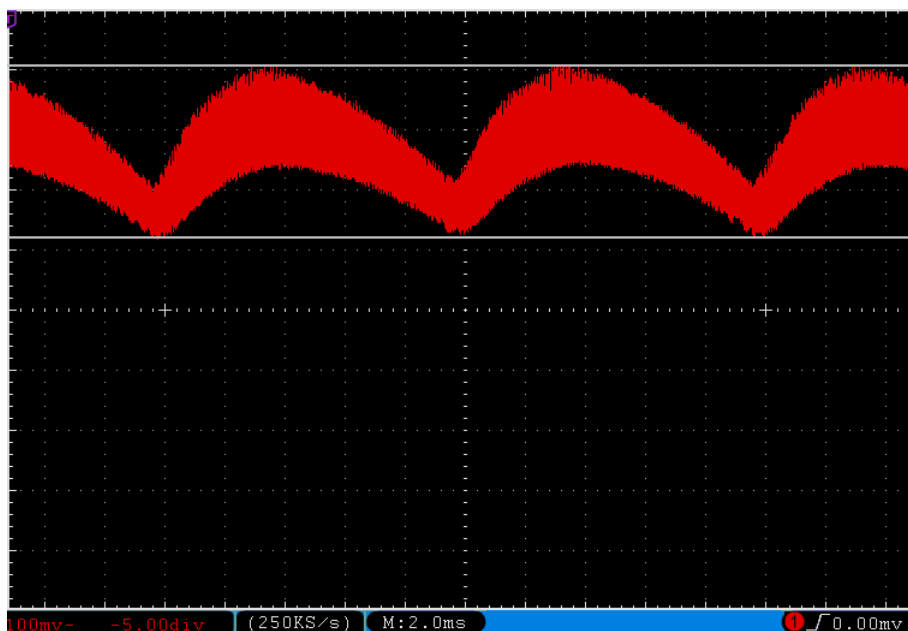
The impact of other light sources, even daylight, is to be excluded for exact measurement of the light source in the flicker component. Thus, the measurement should be done in a darkened room. LiFli is directly arranged next to the light source.

The brightness curves displayed here can be created using ⑨ oscilloscope connected to the voltage output.



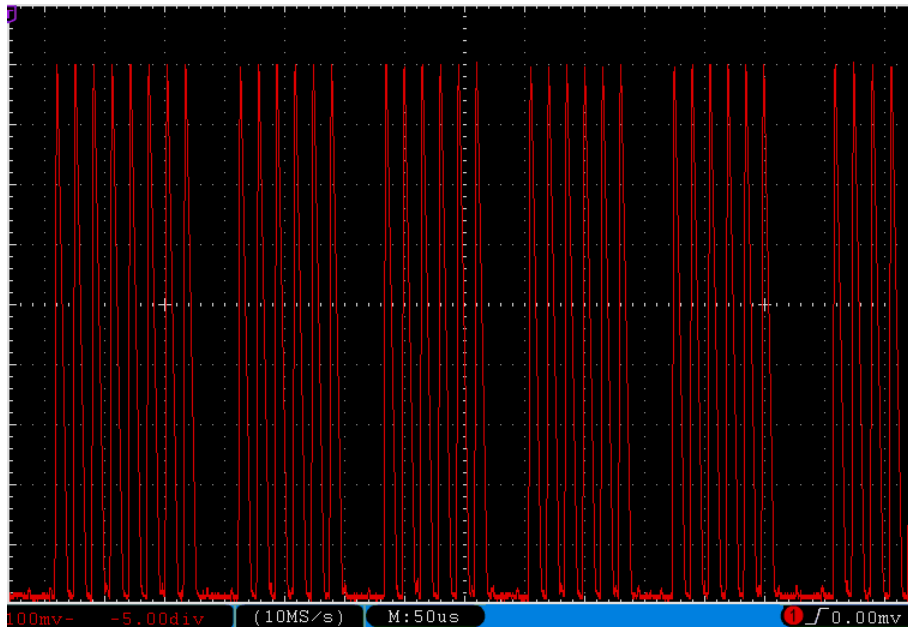
Brightness curve of an incandescent lamp (flicker component 23%, flicker frequency 100 Hz)

The flicker frequency is 100 Hz in case of incandescent lamps and halogen lamps and the flicker component is between 15 % up to 25 %. Low voltage halogen lamps with electronic power supply are an exception.



Brightness curve of a compact fluorescent lamp (flicker component 31%, flicker frequency 49 kHz)

Compact fluorescent lamps, also known as energy-saving lamps have a flicker frequency in the range of approximately 20 kHz to 150 kHz due to the built-in electronic power supply. The flicker component is between 20% to 40%.



Brightness curve of an LED light source (flicker component 31%, flicker frequency 49 kHz)

Since the brightness of LED responds almost instantaneously to its operating current, a general statement on the flicker component and flicker frequency is not possible for these light sources; this is because these depend only on the current source (power supply). The flicker component may be between 0% to 100%. Flicker frequency from 50 Hz up to several hundred Kilohertz is possible.

The quality of current source is of greatest importance for LED light sources.

3. Annex

3.1. Technical information

Frequency range:	50 Hz...400 kHz
Spectral range ($\lambda_{0.5}$):	420..675 nm
Calculation type:	Ripple content according to SBM-2015 Flicker% according to IESNA
Bar display:	18 LED
Measuring range:	2 %...100 %
Resolution:	2 %, 5 %, 10 % depending on the flicker component
Power supply:	Lithium ion battery
Dimensions:	117 x 80 x 32 mm
Weight:	190 g
Operating temperature:	0..40 °C
Humidity range:	10..70 % (non-condensing)

Technical changes reserved.

3.2. Accessories

Cable for voltage output LiFli to BNC (2m)	Art.-Nr. 130
Micro-USB charger 5V/1000 mA	Art.-Nr. 522

3.3. Waste disposal

This product has the recycling symbol in accordance with EU Directive 2002/96/EC. This means the device must be returned to the manufacturer for recycling after its useful life. Waste disposal along with household waste is not done.

Disposal address: Fauser Elektrotechnik
Ambacher Straße 4
D-81476 München



The current version of the manual is available on the homepage www.fauser.biz .
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